



IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant : Giuliano CAVAGLIA Confirmation No: 9565
Appl. No. : 10/523,650
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Title : Continuous Process For Solid Phase Polymerization of Polyesters

TC/A.U. : 1711
Examiner : G. Listvoyb

Docket No.: : CAV3001/REF
Customer No: : 23364

APPEAL BRIEF 37 CFR §41.37

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

This brief on appeal is submitted along with the required fee of \$270.00 under 37 CFR §41.20(b)(2) for a small entity. The period for filing the appeal brief has been extended to expire on March 3, 2010, by the filing herewith of a Petition for a One Month Extension of time and payment of the required fee. This response is timely filed.

Any additional fees necessary for this appeal may be charged against the undersigned's Deposit Account No. 02-0200.

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41.37 (c)(1)(i). REAL PARTY IN INTEREST

The real party in interest is the Assignee of record, COBARR S.P.A.

41.37 (c)(1)(ii). RELATED APPEALS AND INTERFERENCES

There are no related appeals or interferences with respect to the claimed invention which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal known to appellant, appellants' legal representative or assignee.

41.37 (c)(1)(iii). STATUS OF CLAIMS

This application contains 118 claims. Claims 1-55, 57-58, 64-83, and 108 have been canceled from the application without prejudice or disclaimer. Claims 56, 59-63, 84-107, 109-113, 117 and 118 are pending in the present application and have been finally rejected. Claims 114-116 have been objected to but indicated to contain allowable subject matter if rewritten in independent form and are not subject to this appeal. Claims 56, 59-63, 84-107, 109-113, 117 and 118 are the claims on appeal.

41.37 (c)(1)(iv). STATUS OF AMENDMENTS

No amendment was filed after final rejection and the status of the claims is as finally rejected.

41.37 (c)(1)(v). SUMMARY OF CLAIMED SUBJECT MATTER

Claim 56 claims a process for the solid phase continuous polymerisation of polyesters, comprising the steps of:

preparing a mass of polyester prepolymer granules comprising at least one polyester; (Page 8, lines 15 and 16)

feeding said polyester prepolymer granules to a crystallizer and heating them to a temperature of about 140°C to about 235°C to cause the crystallization of the granules; (Page 8, lines 15, 24 and 25)

feeding said crystallized granules into a generally horizontal, cylindrical, heated, first rotating reactor, said first reactor being slightly inclined downwardly from a feeding end thereof; (Page 9, lines 11-14)

producing a purge gas flow inside said first reactor to increase the intrinsic viscosity of said at least one polyester. (Page 10, lines 23-25)

Claim 106 claims the process according to claim 56, wherein the intrinsic viscosity of the polyester is increased at least 0.35 dl/g. (Page 17, lines 5 and lines 11-17, page 24 original claim 53).

41.37 (c)(1)(vi). GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

A). Whether the rejection of claims 56, 59-63, 84-92, 95, 100-107, 109-112, 118 under 35 U.S.C. 103(a) as being unpatentable over Kerpess et al in combination with Coover et al and evidenced by Jones establishes a prima facie case of obviousness?

B). Whether the rejection of claims 93-94 under 35 U.S.C. 103(a) as being unpatentable over Kerpess in view of Coover and Tung establishes a prima facie case of obviousness?

C). Whether the rejection of claims 93, 96-100 under 35 U.S.C. 103(a) as being unpatentable over Kerpes in combination with Coover and Duh et al establishes a prima facie case of obviousness?

D). Whether the rejection of claim 95 under 35 U.S.C. 103(a) as being unpatentable over Kerpes in combination with Coover and Scannapieco establishes a prima facie case of obviousness?

41.37 (c)(1)(vii). ARGUMENT

The reasons why the rejections on appeal need to be reversed is that the rejections fail to consider the teachings of the references in their entirety as the Examiner has failed to consider and resolve the objective evidence as required by *In re Rinehart*, 189 USPQ 143 (CCPA 1976).

As clearly set forth in MPEP § 2141.02 Differences Between Prior Art and Claimed Invention which reads as follows:

VI. PRIOR ART MUST BE CONSIDERED IN ITS ENTIRETY, INCLUDING DISCLOSURES THAT TEACH AWAY FROM THE CLAIMS

A prior art reference must be considered in its entirety, i.e., as a whole, including portions that would lead away from the claimed invention. *W.L. Gore & Associates, Inc. v. Garlock, Inc.*, 721 F.2d 1540, 220 USPQ 303 (Fed. Cir. 1983), *cert. denied*, 469 U.S. 851 (1984) (Claims were directed to a process of producing a porous article by expanding shaped, unsintered, highly crystalline poly(tetrafluoroethylene) (PTFE) by stretching said PTFE at a 10% per second rate to more than five times the original length. The prior art teachings with regard to unsintered PTFE indicated the material does not respond to conventional plastics processing, and the material should be stretched slowly. A reference teaching rapid stretching of conventional plastic polypropylene with reduced crystallinity combined with a reference teaching stretching unsintered PTFE would not suggest rapid stretching of highly crystalline PTFE, in light of the disclosures in the art that teach away from the invention, i.e., that the

conventional polypropylene should have reduced crystallinity before stretching, and that PTFE should be stretched slowly.).

It is stated at the top of page 12 of the Final Rejection, "However, Examiner uses Coover for the purpose of the reactor modification". That is, an alternative device to be used is the use of a somewhat tilted hollow reaction tube which may have a corrugated cross section and which can be rotated around its longitudinal axis. Pre-polymer powder can be introduced into the higher end of the tube and inert gas passed through the tube. (See column 5, lines 15-20 of Coover.) Column 4 of the patent, lines 17 -20, describes that the powder buildup operation is conducted in an enclosed polymerizing zone. Such a zone can be a horizontal tube, upright cylinder or any other chamber through which inert gas can be conveniently moved across the surface of the particles. Clearly, one of ordinary skill in the art would not ignore that the discussion of reactor design relates to powder buildup and not the treatment of granules, which are not powders and require different processing conditions as evidenced by the Reinhardt and Callander declarations of record.

Applicant submits that the declarations under 37 CFR 1.132 of Dr. Callander and Mr. Reinhardt of record, present unrefuted evidence of the patentability of the claimed subject matter over the references cited in the outstanding rejections and clearly explaining the difference between the claimed subject matter and the reasons why one skilled in the art would not combine the references as set forth in the Official Action.

A) The rejection of claims 56, 59-63, 84-92, 95, 100-107, 109-112 under 35 U.S.C. 103(a) as being unpatentable over Kerpes in combination with Coover and as evidenced by Jones should be withdrawn or reversed on appeal.

A-1) The rejection of claim 106 does not stand or fall with the rejection of claims 58, 59-63, 95, 100-105, 107 and 109-112.

A-2) The rejection of claim 112 does not stand or fall with the rejection of claims 58, 59-63, 95, 100-105, 107 and 109-112.

This rejection simply applies the references cited in previously withdrawn rejection, but in reverse order. Nevertheless, there is nothing in the prior art references applied in the rejections, in any combination, which suggest the presently claimed invention which results in an increase in production of metric tons over the prior art, and at reduced cost. The combination of references does not render the claimed subject matter prima facie obvious.

As noted on page 7 of Applicant's specification, "Nowadays, growing polyester and PET demand has given rise to a need for solid-phase polymerisation processes by means of which it is possible to achieve a higher increase of polyester molecular weight and a higher production capacity, typically > 300 metric tons/day on single plant. The purpose of the present invention is therefore to provide a solid phase polymerisation process of polyester that allows to overcome the limitations of the processes known so far by permitting to achieve better results in term of increased intrinsic viscosity of the polyester. A further purpose of the invention is therefore to provide a solid phase polymerisation process of polyester that allows to achieve high production capacities. In the solid phase polymerisation plants also the purge gas flow rate has to be just sufficient to effectively remove the reaction by-products. As a matter of fact, a gas excess results in higher costs both for its supply and for its regeneration and disposal. Therefore, a further purpose of the invention is therefore to provide a solid phase polymerisation process of polyester that allows to reduce the costs due to the purge gas employment."

On the contrary, Kerpes' invention relates to a continuous process for the production of polyester for food packaging, by means of an optimized melt polycondensation and pelletizing, as well as a multi-stage heat treatment of the pellets. Kerpes is concerned about the free acetaldehyde content of PET which needs to be less than 0.5 ppm, and a bound acetaldehyde content of less than 5 ppm, in which these quality values are reproducible in every case, see column 5 lines 25 and 26 of the patent. The first aspect of the process is the melt polycondensation reaction so that the polycondensate (polyester, PET) has, at the reactor outlet, an intrinsic viscosity of 0.60 to 0.95 dl/g. The residence time and temperature of the polycondensation reaction is such to produce a product at the discharge outlet of the pelletizer which has less than

30 ppm, and preferably less than 25 ppm, higher acetaldehyde than it had at the discharge outlet of the reactor.

As declared in Dr. Callander's declaration, paragraph 10., Kerpès teaches that the molecular weight (I.V.) increase, also known as lift, be limited to only the amount needed to remove the acetaldehyde. (Col 3, lines 49-55). To accomplish this, Kerpès unequivocally teaches one of ordinary skill that the I. V. of the melt polymerized material be only slightly lower than the desired final I.V., for example 0.05 to 0.15 dl/g. (See again, Col 3, lines 49-55). Because one of ordinary skill knows that polyester food packaging requires a molecular weight (I.V.) of between about 0.65 dl/g and 1.00 dl/g, the melt I.V. cannot be below about 0.50. A minimum melt I.V. of 0.50 dl/g is outside and mutually exclusive with the preferred maximum of 0.45 dl/g I.V. of Coover (Col. 4, Lines 12-17). Moreover, Kerpès teaches at column 3, line 35 an intrinsic viscosity range of 0.60-0.95 dl/g for the polycondensate at the reactor outlet and prior to the pelletizer. Again, one of ordinary skill in the art would understand this teaching is contrary to the teaching of Coover and leads one away from using the polycondensate of Kerpès in Coover or Coover's reactor in the Kerpès process. There is no rational explanation of why one of ordinary skill in the art would combine the references in view of the clear teaching away from such a combination as would be understood by one of ordinary skill in the art to which the invention pertains. Even under KSR, Applicants teaching may not be used to combine the references.

As noted at column 2, line 36 of the Kerpès patent, the polyester pellets, having a specific surface area of 1.8 to 2.9 m² /kg are hardened at a temperature in the range between 30° and the first softening temperature, Te-1(60-75°C) in air. The hardened polyester pellets are crystallized at a temperature and for a time sufficient for the first-softening temperature to increase by 100° to 150°C, which value lying in the same range as the temperature at which the subsequent dealdehydization is carried out. During dealdehydization, at a temperature in the range of 175° to 225°C, the mass ratio of gas to polyester lies in a range from 0.05-10.0 to 1.0. This hardening process is not set forth in the claims on appeal and would unnecessarily add to processing costs which are avoided by the process of the present invention.

The pellet size of Kerpès can be determined from column 4, lines 9-13. A pellet size of 5 mg, preferably 8-15, equates to a particle diameter of 1.98mm. (The specific gravity of polyester ranges from 1.30 to 1.35 depending upon whether it is amorphous or crystalline). This is contrasted later with the maximum powder size of Coover being substantially less than 1 millimeter.

Kerpès Teaches Reactor Design to One Of ordinary skill in the art.

It is stated on page 4 of the Final rejection that Kerpès does not teach reactor design. However, Kerpès does teach reactor design at column 3 for the melt polycondensation reactor in which the reactor has multiple annular disks. In addition, it is noted at line 60 of column 3 that the pelletizer is, in accordance with the invention, directly connected to the outlet of the polycondensation reactor. At column 4, lines 46-47, of Kerpès, it is stated that the hardened pellets are subsequently subjected, in the conventional manner, to crystallization which is then followed by dealdehydization in a solid bed. A fair interpretation of Kerpès, by one of ordinary skill in the art, is that the standard PET process is utilized with the exception of the specific requirements specified in Kerpès.

Applicant made of record, US Patent 6,403,762 to Duh which was issued on June 11, 2002, which is just prior to the priority date for the present application. The inventor on the '762 patent, Ben Duh, is the same inventor as on the '701 Duh reference applied in an outstanding rejection in the present application. This is evidence of the '762 patent's relevancy to the issues in the present appeal. Figure 1 of this patent is specifically noted as representative of the apparatus used for a conventional solid state polymerization process for PET at column 5, lines 38-45 of this patent. As noted therein, the dried and annealed pellets are then preheated to the reaction temperature in the preheater 4 before being charged into the reactor 5. This is obviously a vertical reactor which one of ordinary skill in the art would clearly understand to be the type of reactor used in the Kerpès "conventional" process and which is also discussed in the background of the invention for the present application. Therefore, Kerpès does describe reactor design which is to use to a conventional reactor system which would be understood by one of ordinary skill in the art to be the

vertical reactors as discussed in the background of the present invention and not a horizontal reactor as urged in the Final Rejection.

The statement in the middle of page 6 of the Final Rejection that, "Use of horizontal, cylindrical, rotary reactor, which is being slightly inclined is beneficial, since it creates an reaction environment, allowing more effective removal of water and aldehydes" has been carefully considered but is most respectfully traversed. There is no indication in the Final Rejection of the basis for this statement. In fact, the Declarations of both Dr. Callander and Rinehart, each at point 11, disagree with the statement and explain why such a statement is not technically correct. The reason is that the gas lies on the top fo the bed in the rotating reactor whereas the gas moves through the entire bed in the upright reactor. By not reconciling the statement with the objective, it is evident that the Examiner has not considered the objective evidence as required by In re Rinehart, thus there can be no prima facie case of obviousness. Additionally, there is no disclosure of this in the Kerpes reference which directs one skill in the art to use of conventional vertical reactors. There also is no disclosure of this in the Coover reference which is the secondary reference relied upon in the rejection. This statement is controverted by Dr. Callander, see paragraph 13 of his declaration and Rinehart at 11. Dr. Callander's Declaration at 13 states:

13. I disagree with the Examiner's position that the rotating reactor is a more effective process for the removal of water and aldehyde. I know of no evidence to support that contention and in fact, believe it to be the opposite. As explained in Rinehart (Rinehart Declaration at 11) the gas in the rotating reactor lies on top of the bed, whereas the upright cylinder, the gas passes through the entire bed from the bottom to the top, thus I would expect the upright cylinder to be more efficient, which explains why it is the workhorse of industrial practice.

Coover, as discussed in detail previously, relates to an entirely different process to provide small powder particles contrary to the granules used in the present invention and the assertion on page 5 of the Final Rejection which omits the modifier, small powder, from the word particles to describe Coover's teaching. Coover does not prepare a mass of prepolymers particles but of powder particles and not granules as would be appreciated by one of ordinary skill in the art. These powder particles are

feed into a rotary reactor. However, it does not establish an equivalence for solid phase polymerization processes using powders and those using granules as in the present invention. As stated at column 4, lines 18-22 of this patent, the powder buildup operation is conducted in an enclosed polymerizing zone wherein at least 5% of the volume is occupied by the particles (which are not granules). Such a zone can be a horizontal tube, upright cylinder or any other chamber through which inert gas can be conveniently moved across the surface of the particles. This does not support the allegation, in the middle of page 6 of the Final Rejection, that it would be obvious to a person of ordinary skill in the art to use a horizontal, cylindrical, rotary reactor in the Kerpes process, on the basis that this reactor design allows better removal of water vapors and aldehydes which is an unsubstantiated allegation. Again, there is no support for this statement nor has the Examiner pointed to any reasons to substantiate this allegation. It is most respectfully submitted that this statement simply represents the use of hindsight based upon Applicant's disclosure and even under KSR, such hindsight reconstruction is impermissible.

Moreover, there are the well known differences in powder and pellet processes as noted in the prior art and discussed in the Rinehart declaration of record. Mr. Rinehart explains in his Declaration that powders are normally processed in horizontal reactors, but that when using pellets it is preferred to not use horizontal rotating reactors due to the creation of undesirable fines when feeding pellets to a horizontal rotating reactor (see Declaration, paragraphs 12 and 13). This is evidence of record which contradicts the Examiner's position that one of ordinary skill in the art would use a horizontal rotating reactor for powders in a process design for granules in view of the understanding of one of ordinary skill in the art of the differences in processing granules and powders.

These difference are further emphasized in the Callander declaration also of record. As discussed therein, Coover on the other hand is diametrically opposed to Kerpes' requirement of a low I.V. lift. Rather than the IV lift being less than 0.15 dl/g, Coover teaches that the I.V. lift be at least 0.3 units and usually 0.4 units or more. (Col 2, Lines 37-39). Processing granules under these conditions would lead to the unmelts previously noted in the Callander declaration and as explained in the Callander

declaration would render the granules of Kerpes unsuitable for use in the bottle of Kerpes, as taught by Kerpes (Col 1, lines 32-34).

Coover et al avoids the high I.V. skin and unmelts noted in the Callander declaration by using a very fine ground powder which overcomes the diffusion effects. Moreover, Dr. Callander agrees with Mr. Rinehart's declaration and his patent teaching that powders are not suitable for making bottles. The Callander declaration also notes that Kerpes et al requires a very specific granule size (Col 4, Lines 9-13), which is much larger than the powder of Coover and therefore does not permit grinding. Therefore, in order to meet the granule size required of Kerpes, one of ordinary skill is left with adding the granules of Kerpes et al to the rotating reactor of Coover et al and incurring its disadvantages noted below.

As stated in item 11 of the Callander declaration, The use of the granules of Kerpes in the rotating reactor of Coover et al would destroy the utility of the granules in Kerpes for bottles due to the discoloration of the resin. The polyester resin industry has for years measured color on its resin with discoloration being considered an almost absolute disqualification for use in bottles. While some polyester bottles are intentionally colored (green for 7UP, Amber for Beer), the vast majority of polyester bottles used for soft drinks are colorless/clear and as noted by Kerpes, the non-colored packaging should be highly transparent and subjectively colorless (Col 1, Line 34). Coover et al teaches that particles larger than a 20 mesh screen (840 micron or 0.840 mm) [such as Kerpes size of 1.98mm] "tend to introduce discoloration and slow down the rate of molecular weight build up" (See Col 4, lines 71 – 73 and the previously defined particle size of less than 20 mesh (0.840 mm at col 2, line 23) with less than 25% below 200 mesh (0.069mm). As also noted in the Callander declaration at 11, the required particle size of granules in Kerpes et al is much larger than 20 mesh (see earlier discussion noting the size of Kerpes particle to the approximately 1.98 mm and the Kerpes granules would therefore process slower and would, in the end be discolored and make a bottle which is not subjectively colorless as required by Kerpes. Since making bottles is a primary purpose of Kerpes, it is inconceivable that one of ordinary skill would take the large granules of Kerpes et al and process them in a

rotating reactor of Coover et al, when Coover et al says that the reaction rate will be slower and the resulting resin, and therefore bottle, will be discolored.

The size of the finely ground powder used in Coover is most evident from col. 2, lines 22-24 of the reference. This section states that the particles of prepolymer are capable of completely passing through a 20 mesh screen. One of ordinary skill in the art understands that a 20 mesh screen has openings of about 841 microns (0.841 mm). Accordingly, all particles in Coover must be smaller than 841 microns in order to pass through the openings in 20 mesh screen and the majority must be less than 30 mesh or 0.595 mm.

In this regard, Applicant wishes to point out that the particle size range taught for the Coover prepolymer particles would be understood by one of ordinary skill to be a powder and not granules as required by the presently claimed process. See column 4, line 18 of Coover which refers to powder buildup and the Rinehart declaration of record, paragraph 6, which describe the polyester powders of Coover. See also USP 6,344,539 which at column 1 lines 18 -21 points out that it is known in the prior art that granules have at least one dimension greater than 1mm. Thus, one of ordinary skill in the art would clearly understand the meaning of granule as used in claim 56 and further amendment of this term is not necessary. Note also dependent claims 96-100 which specify particles size ranges consistent with the 1mm size for granules. The Rinehart declaration further notes that powders are not granules (pellets/chips).

The distinction between processes using granules and powders is well understood by one of ordinary skill in the art to which the invention pertains. As noted at column 1, line 57 through column 2, line 4 of the Rinehart USP 4,876,326 patent, "For example, it has generally been accepted practice to use polyester prepolymer in the form of pellets or chips in vacuum and static bed processes and finely ground powder in fluidized bed processes. The reason for this is that experience has shown that finely ground powders tend to agglomerate in vacuum processes, resulting in slower polymerization rates and a need to regrind the high molecular weight polyester resin produced. Experience has also shown that, in static bed processes finely ground powders will channel or fissure, resulting in uneven polymerization and prolonged polymerization rates. On the other hand, the use of pellets or chips in fluidized bed

processes is not economically feasible in view of the velocity and volume of inert gas needed to suspend the pellets or chips and the size of the equipment required to do so.

Thus, one of ordinary skill in the art of processing granules (Kerpes) would not look to the teachings of a powder process (Coover) to modify a process using granules in view of the established differences in the processes as recognized in the art.

This is especially true in view of Coover, which at column 4, lines 69-71, tacitly teaches one of ordinary skill in the art not to use granules but to stay within the limits set forth above, which at column 2, line 23 describes the 20 mesh requirement for the particle size. This is a teaching away from the use of granules as required by the presently claimed invention. Applicants also note MPEP §2143.01, which states in part that, if a proposed modification would render the prior art invention unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification. *In re Gordon*, 733 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984).

To the contrary, the granules recited in claim 56 are larger than 800 microns. As indicated in, e.g., claim 97, the granules have a diameter of 1 mm to 5 mm. As also indicated in, e.g., claims 96 and 100, the granules have a volume between 1 mm³ and 125 mm³. Accordingly, as evidenced by both the claims of the instant application and the general understanding of the term granule by one of ordinary skill in the art, based on the evidence of record including patents and the Rinehart declaration, Applicants respectfully submit that the granule recited in claim 56 is of a size generally larger than the finely ground particles disclosed in Coover.

That one of ordinary skill in the art of polyester resins knows that granules are larger than powders and that granules are different from powders is also established in the Rinehart patent referred to in the Rinehart declaration, of record. The Rinehart patent teaches that powders and granules are functionally different. Powders cannot be processed effectively using pellet/granule processing equipment due to channelling as would be appreciated by one of ordinary skill in the art. Accordingly, it is most respectfully requested that this aspect of the rejection be withdrawn.

It is urged on page 6 of the Final Rejection, that regarding claims 109-111 that these claims are related to process design which can be readily adjusted by one of ordinary skill in the art depending upon the features of the specific process. This

argument requires first that one of ordinary skill in the art would substitute a horizontal reactor for the conventional vertical reactor for treating granules which has been demonstrate not to be the case. Moreover, even if this substitution were made there is nothing in the prior art to suggest the specific parameters in the claims would result in the unexpect increase in yield and quality of product and the commercial success achieved by the presently claimed invention. Further, it is most respectfully submitted that there is an infinite number of variables to be changed with respect to purge gas flow, temperatures of reactions, types of reactors and the like and clearly, the presently claimed invention, particularly in view of the commercial success and increase in production, is not suggested nor rendered obvious by this combination of references. Accordingly, it is most respectfully requested that this rejection be withdrawn or reversed on appeal

A-1) The rejection of claim 106 does not stand or fall with the rejection of claims 58, 59-63, 95, 100-105, 107 and 109-111.

Claim 106 claims a process for the solid phase continuous polymerisation of polyesters, comprising the steps of:

preparing a mass of polyester prepolymer granules comprising at least one polyester; feeding the polyester prepolymer granules to a crystallizer and heating them to a temperature of about 140°C to about 235°C to cause the crystallization of the granules. The crystallized granules are feed into a generally horizontal, cylindrical, heated, first rotating reactor, the first reactor being slightly inclined downwardly from a feeding end thereof. Producing a purge gas flow inside said first reactor to increase the intrinsic viscosity of the polyester at least 0.35 dl/g. This is not achievable by conventional vertical reactors as noted at the bottom of page 5 of Applicant's specification which notes that such conventional plants can increase polymer IV by 0.12 dl/g to 0.25 dl/g which is well below the results achieved by claim 106.

A-2) The rejection of claim 112 does not stand or fall with the rejection of claims 58, 59-63, 95, 100-105, 107 and 109-112.

Claim 112 claims a process for the solid phase continuous polymerisation of polyesters, comprising the steps of:

preparing a mass of polyester prepolymer granules comprising at least one polyester;

feeding said polyester prepolymer granules to a crystallizer and heating them to a temperature of about 140°C to about 235°C to cause the crystallization of the granules by subjecting the polyester granules to a crystallisation step in a fluidised-bed crystallizer having at least one bed, said bed being fluidised by means of a gas flow sufficient to generate the fluidisation of the polyester granules with or without mechanical vibration;

feeding said crystallized granules into a generally horizontal, cylindrical, heated, first rotating reactor, wherein the rotating reactor is inclined downwardly from a feeding end thereof at an angle of 0.1 to 12 degrees to the horizon and rotates at a speed of 0.1 to 10 rpm; and wherein the granules form a bed of granules in the rotating reactor with a maximum height of 4 to 5 meters

producing a purge gas flow inside said first reactor to increase the intrinsic viscosity of said at least one polyester.

As discussed in the paragraph bridging pages 9 and 10 of Applicant's specification, owing to the configuration of the HCIRR reactors and in particular owing to their inclination by an α angle in the range 0.1° and 12°, preferably between 1° and 6° with respect to the horizontal line, the maximum polyester granules bed height is 4-5 meters. This in turn means very low compaction pressure if compared to conventional reactors, achieving thus the most important condition required to obtain either high molecular weight PET or to obtain high input in terms of metric tons per day in a single line solid phase polymerisation plant. Advantageously, the combination of the inclination and the rotation, preferably with a speed between 0.1 and 10 rpm of the HCIRR 15 and provides to constantly renew the inter-granular contact areas so that the polyester granules do not have a chance to creep into one another. This is not suggested by the combination of references relied upon in the Final Rejection. Accordingly, it is most respectfully requested that this rejection be withdrawn or reversed on appeal.

B). The rejection of claims 93-94 under 35 U.S.C. 103(a) as being unpatentable over Kerpes in view of Coover and Tung does not establish a prima facie case of obviousness and should be withdrawn or reversed on appeal

The rejection of claims 93-94 under 35 U.S.C. §103(a) as being unpatentable over Kerpes in combination with Coover and Tung et al. has been considered but is most respectfully traversed. The teachings of the Tung et al reference do not overcome the deficiencies of the Kerpes and Coover references as discussed above. Tung et al note that the low molecular weight polyester prepolymers utilized in solid state polymerization are generally in the form of pellets or chips at column 1, lines 23-26. The reference notes the sticking problem and the advantage of forming a crystalline chip but in not using a thermal heating process for this but instead, crystallization occurs in the presence of an organic vapor. This is further evidence for not using the heat crystallization process of the present invention and teaches away from the combination of Kerpes and Coover. Accordingly, it is most respectfully requested that this rejection be withdrawn or reversed on appeal.

C). The rejection of claims 93, 96-100 under 35 U.S.C. 103(a) as being unpatentable over Kerpes in combination with Coover and Duh et al does not establish a prima facie case of obviousness and this rejection should be withdrawn or reversed on appeal.

The rejection of claims 93, 96-100 under 35 U.S.C. §103(a) as being unpatentable over Kerpes in combination with Coover and Duh et al.('701) has been carefully considered but is most respectfully traversed. The teachings of Duh do not overcome the teachings of the primary references for the reason discussed above.

It is stated on page 9 of the Final Rejection that Coover and Kerpes do not teach the shapes of the particles. Kerpes' disclosure relates to pellets which are generally a spherical or cylindrical shaped body as defined by Webster's Collegiate Dictionary, Tenth Edition. Kerpes teaches a specific particle size. Coover is quite explicit that the

"particles" are powders having specific size limitations, way below the size of the particles in Kerpeş. The references are not combinable for this reason alone.

Applicant notes that Duh discloses using prepolymer granules in the shapes of pellets, spheres, chips or cubes for solid state polymerization, see column 1 line 20. The Final Rejection states at page 9 that, "Duh discloses a solid-state polymerization for polyethylene naphthalate. He teaches that feeding prepolymer typically contains solid granules in the shape of pellets, spheres, chips or cubes." Duh does not, as stated in the Final Rejection, teach that those shapes are advantageous since the formation of undesirable very high molecular weight fraction is reduced. Duh does states that the use of granules is advantageous in that the handling of high molecular weight ultra-high viscosity molten polymers is eliminated.

It is noted in the reference that the prepolymers are generally converted from the amorphous to the crystalline state prior to solid state polymerization in order to raise their sticking temperature. This is done in order to keep the pellets or chips of polyester prepolymer from sticking together as a solid mass in the solid sates polymerization reactor. However, Applicants note the comments above regarding the use of only finely ground particles or powder in the method and apparatus of Coover. Because Coover discloses a horizontally oriented rotating reactor, shear force will be exerted on any relatively large granules in the shape of pellets, chips, cubes or spheres placed therein and cause the creation of undesirable fines. In fact, any pellets, spheres, chips or cubes placed therein will be reduced to powders, thus making a step of creating pellets, spheres, chips or cubes worthless.

Furthermore, Coover expressly notes at col. 4, lines 69-73 that particles having a size larger than 20 mesh (i.e., 0.8 mm) are undesirable for use in the method and apparatus of Coover because they tend to introduce discoloration and slow down the rate of molecular weight buildup. Thus, Applicants respectfully submit that, with respect to modifying the invention of Coover to use larger particles based on the teachings of Duh, the Coover reference clearly teaches away from any such modification. One of ordinary skill in the art reading the Coover reference will readily understand that using larger particle sizes is undesirable. The particle size as taught by Coover, must be in the range specified in Coover, see column 4, lines 70 and 71, and column 2, lines 23

and 24. One of ordinary skill in the art would appreciate that this allows the process to be carried out in a horizontal reactor.

It is urged on page 10 of the Final Rejection that it would be obvious to a person of ordinary skill in the art that particle size and shape (i.e. surface areas at given mass) is the most important factor for diffusion of water from the particle. At high surface areas equilibrium of post polymerization reaction shifts to molecular weight increase, which makes a process more efficient. Therefore it would be evident to one skilled in the art to use powder or a powder particle as having the largest surface area and not the granules of the presently claimed invention since the process using granules would be less efficient in accordance with this analysis. Accordingly, it is most respectfully requested that this rejection be withdrawn or reversed on appeal.

D). The rejection of claim 95 under 35 U.S.C. 103(a) as being unpatentable over Kerpes in combination with Coover and Scannapieco does not establish a prima facie case of obviousness

The rejection of claim 95 under 35 U.S.C. §103(a) as being unpatentable over Kerpes in combination with Coover and Scannapieco has been carefully considered but is most respectfully traversed since the Scannapieco references does not overcome the deficiencies of the primary references for the reasons discussed above.

The Official Action urges that Scannapieco discloses using granules having carboxyl end group content that is less than 30% and that it would be obvious to use prepolymers with carboxyl acid group content below 30% in order to achieve high rate of the polymerization. However, this teaching does not overcome the deficiencies of the primary references as discussed above. Accordingly, it is most respectfully requested that this rejection be withdrawn or reversed on appeal.

The Examiner states that Coover produces better mass transfer and better and more uniform contact of all particles with the drying gas.

First, this is unproven and unexplained by the Examiner. Second, it is at odds with Verne Rinehart's declaration describing how the tubular vertical solid state

reactor works. First, it generates no fines as shear is minimized pt 9. Second, the tubular vertical reactor also provides much more homogeneous mass transfer due to its uniform cross section (pt 9 and pt 10) "In the static bed tubular reactor the inert gas is passed homogenously through the polymer flowing from bottom to the top". This is at direct odds with the Examiner's statement of more uniform contact. Third, the inert gas does not pass through the bed as assumed by the Examiner, but passes over the bed as explained in Rinehart pt 11.

Rinehart mentions the problem of high fines generated in a rotating reactor, a disincentive for one of ordinary skill to use the reactor in Coover to produce the article of Kerpes. Dr. Callander (pt 10) explains that these create visual unmelts rendering the bottle of Kerpes unsuitable for its intended use as set forth by Kerpes. Dr. Callander's knowledge in this regard is based upon personal knowledge and observation of the phenomenon. This is unrefuted by the Examiner.

Callander focuses on the vast mutually exclusive nature of the processes of Cooper and Kerpes, the major one being the pellet size. Kerpes says (c4, L14) that the pellet must be at least 5mg, preferably larger. 5mg at 1.33 g/cm³ means the diameter of the pellet must be greater than 1.98mm, where as Coover says all the materials must pass through a 20 mesh screen meaning that the maximum particle size is 0.84mm, and 25% passing through a 200 mesh screen which is less than 0.069 mm. (See Appendix on mutual exclusivity).

Dr. Callander did not conclude that the modification of Kerpes to use the rotating reactor of Coover may destroy Kerpes process. Dr. Callander said that the modification of Kerpes to use the rotating reactor of Coover would destroy the utility of the bottle made from the resin of the modified Kerpes process. Dr. Callander reached this conclusion based upon the evidence in the disclosure of Coover in combination of the requirements disclosed in Kerpes. Coover states that granules larger than 20 mesh will tend to discolor in the rotating horizontal reactor. Kerpes teaches that pellets must be substantially larger than 20 mesh and that the finished bottle of Kerpes is to have no subjective color. Since larger particles of Kerpes are expected to discolor, as per Coover, not Dr. Callander, and discoloration renders the resin unsuitable for its intended use, per Kerpes, not Dr. Callander; Dr. Callander

concludes that one of ordinary skill in the art would not take the large granules of Kerpes and process them according to the horizontal rotating reactor of Coover.

Coover's uniform IV and relatively narrow molecular weight distribution are due to the nature of a powder. (Rinehart pt 12). Dr. Callander explains what happens when fines generated in the shearing conditions of the rotating reaction are solid phase polymerized with larger granules – high IV unmelts occur.

The statement by the Examiner that the rotating reactor has a more effective removal of water and aldehydes remains unsupported and is in fact rebutted by Dr. Callander who states that the tubular upright vessel is superior as the gas passes through the entire bed.

The fact that any reactor is slightly inclined is not true, the tubular vertical non-rotating reactor as detailed in Rinehart and considered the industry workhorse by Dr. Callander is not "slightly" inclined as it is approximately 90 degrees off the horizontal and could never be considered "slightly" inclined as in 0.1 – 12 Degrees slope.

CONCLUSION

In view of the above arguments, the rejection of the claims on appeal should not be sustained. The prior art rejection should be reversed and the application passed to issue.

Respectfully submitted,
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41.37 (c)(1)(viii) Claims appendix

56. A process for the solid phase continuous polymerisation of polyesters, comprising the steps of:

preparing a mass of polyester prepolymer granules comprising at least one polyester;

feeding said polyester prepolymer granules to a crystallizer and heating them to a temperature of about 140°C to about 235°C to cause the crystallization of the granules;

feeding said crystallized granules into a generally horizontal, cylindrical, heated, first rotating reactor, said first reactor being slightly inclined downwardly from a feeding end thereof;

producing a purge gas flow inside said first reactor to increase the intrinsic viscosity of said at least one polyester.

59. The process according to claim 56, wherein the polyester granules fed into said first reactor have a temperature in the range of 185-225°C.

60. The process according to claim 56, wherein the polyester granules fed into said first reactor have a temperature in the range of 180-230°C.

61. The process according to claim 56, wherein the polyester granules fed into said first reactor have a crystallisation degree (X_c) greater than 10%.

62. The process according to claim 56, wherein the polyester granules fed into said first reactor have a crystallisation degree (X_c) greater than 20%.

63. The process according to claim 56, wherein the polyester granules fed into said first reactor have a minimum crystallisation degree (X_c) in the range of 0 - 70%.

84. The process according to claim 56, wherein said-purge gas is an inert gas or air.

85. The process according to claims 56, wherein said-purge gas is air with a dew point less than -30°C .

86. The process according to claim 56, wherein the purge gas is a mixture of gases chosen from the group consisting of nitrogen, noble gases, carbon dioxide, carbon monoxide and oxygen, and wherein the oxygen content is less than 10% by weight.

87. The process according to claim 56, wherein said purge gas is a mixture of gases chosen from the group consisting of nitrogen, noble gases, carbon dioxide, carbon monoxide and oxygen, and wherein the oxygen content is less than 6% by weight.

88. The process according to claim 56, wherein the purge gas has been purified of organic impurities to a level less than or equal to 100 p.p.m. by weight (CH_4 equivalent) and is then recycled to the first reactor.

89. The process according to claim 56, wherein said at least one polyester is polyester having at least about 75% of its acid moieties provided by terephthalic acid.

90. The process according to claim 89, wherein the polyester has an IPA (Isophthalic Acid) content in the range of 1-20%.

91. The process according to claim 89, wherein the granules of polyester fed into said first reactor have an intrinsic viscosity in the range between 0.55 and 0.65 dl/g.

92. The process according to claim 89, wherein the granules of polyester fed into said first reactor have an intrinsic viscosity in the range between 0.25 and 0.75 dl/g.

93. The process according to claim 56, wherein said at least one polyester is PEN polyethylene naphthalate.

94. The process according to claim 56, wherein said at least one polyester is

PBT polybutylene terephthalate.

95. The process according to claim 56, wherein the granules fed in the first reactor have a carboxyl end groups content in the range of 10 - 45%.

96. The process according to claim 56, wherein the granules are cube-shaped with volumes between 1 mm^3 and 125 mm^3 .

97. The process according to claim 56, wherein the granules are spherical with a diameter between 1 mm and 5 mm.

98. The process according to claim 56, wherein the granules are extended cylinders of length less than 10 mm and circular or square cross-section having, respectively, a diameter or side less than 5 mm.

99. The process according to claim 56, wherein the polyester granules are pancake-like platelets of diameter less than 3 mm and thickness less than 3 mm.

100. The process according to claim 56, wherein the polyester granules have an irregular shape with a volume between 1 and 125 mm^3 .

101. The process according to claim 56, wherein the mass of prepolymer crystallised granules is achieved by subjecting the polyester granules to a

crystallisation step in a fluidised-bed crystallizer having at least one bed, said bed being fluidised by means of a gas flow sufficient to generate the fluidisation of the polyester granules with or without mechanical vibration.

102. The process according to claim 101, wherein said-gases employed for the crystallisation are inert gases or air.

103. The process according to claim 101, wherein said crystallisation step is performed with a residence time selected from the group consisting of between 2 and 20 minutes and 10 to 15 minutes.

104. The process according to claim 56, wherein the granules are heated to cause the crystallisation up to temperatures between 200-225° C.

105. The process according to claim 56, wherein the polyester granules inside said first reactor are subjected to at least one of a solid phase polycondensation, drying, and dealdehydisation.

106. The process according to claim 56, wherein the intrinsic viscosity of the polyester is increased at least 0.35 dl/g.

107. The process according to claim 89, wherein the intrinsic viscosity of the polyester is increased at least 0.4 dl/g.

109. The process of claim 56, which allows a high degree of plug flow to yield high uniformity and homogeneity of the final product.

110. The process of claim 109 wherein the rotating reactor is at an angle of 0.1 to 12 degrees to the horizon and rotates at a speed of 0.1 to 10 rpm.

111. The process of claim 101 wherein the rotating reactor is at an angle of 0.1 to 12 degrees to the horizon and rotates at a speed of 0.1 to 10 rpm.

112. The process of claim 111, wherein the granules form a bed of granules in the rotating reactor with a maximum height of 4 to 5 meters.

113. The process of claim 112, wherein the granules internal of the bed behave as a rigid body and rotate at the same rate as the rotating reactor and when said particles are at the surface of the bed, slide at the surface and are subject to an inert purge gas flowing in a direction counter current to the flow of the granules.

117. The process of claim 112, wherein the degree of crystallization is from 10-30% when the granules enter the first rotating reactor.

118. The process of claim 56 further comprising the step of forming beverage bottles from said granules from said rotating reactor.

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41.37 (c)(1)(ix) Evidence appendix

Declaration of Dr. Douglas David Callander under 37 CFR § 1.132

Declaration of Verne R. Rinehart under 37CFR § 1.132

United States Patent 6,403,762 issued Jan 29, 2002, Duh

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41.37 (c)(1)(ix) Related proceedings appendix

None